

First Annual Report to NOAA Office of Global Programs

Project title:

“Improvement of Forecast Communication and Use between Indigenous and Governmental Groups in Australia: Managing Fire in Arid and Semi-Arid Lands under Conditions of Interannual Climate Variability”

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Period covered by this report: March 1, 2004 to January 1, 2005

Grant no. NA03OAR4310071

I. Preliminary Materials

A. Project Abstract

This project seeks to explore and remedy the barriers to communication that exist between traditional and scientific interannual climate forecasting. It proposes an analytical framework and a set of methodologies to examine three types of obstacles to communication (linguistic, conceptual and organizational differences). It integrates remote sensing with social science methods such as ethnography and interviews. It indicates a process to develop and evaluate projects that will address the obstacles, and to disseminate the results of these projects. More concretely, it examines the use of forecasts to direct land management decisions in the fire-prone savannahs of northern Australia. In this region, Indigenous (Aboriginal) and Euro-Australian land managers use forecasts to set the time and level of controlled fires. These fires reduce the fuel load so that catastrophic fires are avoided, and they also serve to manage vegetation (to increase fodder and support wildlife, and also to conserve biodiversity through maintaining the mosaic of different types of plant communities). Indigenous and Euro-Australians often misunderstand each other's behaviors and rationales for behaviors. However, each group would benefit by learning from the other and by coordinating their forecast use and fire decisions more closely. The research will focus on three sites to consider a range of different relations between the two groups and a range of environmental parameters. The project will establish close cooperation with the School of Geography and Environmental Science at Monash University in Melbourne.

B. Objective of Research Report

The objective of this report is to present the last year's activities in this project, with an emphasis on field visits, interviews, archival research and remote sensing. Interactions with the climate forecast community, with end-users and with other researchers are described. Preliminary results are presented in several areas: a discussion of changing institutional and policy framework for fire management in northern Australia, a report on the use of remote sensing to describe and analyze patterns of fire starts and spreads, and some findings about the relations between traditional and modern environmental

monitoring and forecasting. It emphasizes the potential compatibility between these different knowledge systems and the promising initial efforts to bridge them, while also recognizing the institutional obstacles to such integration.

C. Approach The approach includes a number of components.

ethnographic research. This research takes place in rural settings with Indigenous Australians and Euro-Australian pastoralists and in agency settings for meteorological, resource and fire management organizations. Ethnographic techniques in socio-cultural anthropology are used to establish the patterns of forecast production, distribution and use in both systems. This research begins with the identification of key informants and extended conversations with them. Open-ended interviews and participant observation with a wider set of individuals establish recent history and current practices regarding environmental monitoring, forecast preparation and decision-making regarding fire starts [Bernard 1988]. Particular care will be taken to respect Indigenous views of privacy and of restrictions on circulation of information. An important point in this project is that ethnographic research will be conducted among both Indigenous Australians and Euro-Australians.

linguistic analysis. Techniques from linguistic anthropology are used to establish the rules that govern conversations, including participation, choice of topic, and procedures for reaching conclusions. Network analysis establishes the linkages through which information circulates. In an analytical sense, any forecast system must include observation of the environment, circulation and evaluation of these observations, development of forecasts from these observations, circulation and evaluation of the forecasts, and development of applications (modifications of standard activity patterns); moreover, all of these phases must involve some sort of verbal exchange, whether oral, written or electronic. However, in any specific forecast system, these phases may be subdivided or linked, and the social and linguistic conventions that govern the communication may differ.

fire logs. We will ask a sample of Indigenous Australian and Euro-Australians, including both residents and managers, to keep fire logs in which they record fire starts and fire histories. Rather than imposing one set of categories on all users, we will encourage users to record fires using their customary categories, whether traditional or scientific. This technique of local monitoring can be used to assess local environmental perception. The remote sensing data will be used not just to evaluate the accuracy of the logs, but also to see what kind of linguistic, conceptual and organizational filters both groups use to describe fires.

remote sensing. This project integrates ground-based and remote sensing data, a link that has been extensively developed in other tropical areas. In this study we have a three-year program of monitoring fire activity (marked by developing fire scars) throughout the fire season (April-October) at each of the field research sites. Since we are concerned with areas of several hundred km² in each case, we use the MODIS satellite data (250 m or better pixel size) available from the ACRES website in Australia (http://www.auslig.gov.au/acres/prod_ser/modisprice.htm). We have developed routines to automatically capture these site-specific data on a regular basis throughout this study. We will import the data to ERDAS IMAGINE and use change detection algorithms to

map the developing fire scar mosaics at each site through the season. This information will be overlain over a digital elevation model (DEM) of each region. All of this work will all be undertaken within the GIS Laboratory at Monash University and will cover the fire seasons of 2004-2006.

archival data. Extensive archives on land title and use, resource utilization patterns and social/political processes are available at the state/territorial and national level in Australia. The archives for documenting Aboriginal history are far richer than in many other nations. These materials provide a time depth to the study and help clarify the institutional dynamics of access to land.

D. Description of matching funds

There are no matching funds for this project to date. The CRED project (www.slimatedecisions.ciesin.columbia.edu) may provide some support for videotaping interactions with forecasts and end-users.

II. Interactions

A. Interactions with decision-makers

A visit to Australia in March 2004 allowed Orlove to make several visits to the offices of bushfire councils, the organizations in each state or territory of Australia that have responsibility for setting the regulations to allow different groups of landowners and resource managers to start controlled burns. These councils also have the responsibility to extinguish fires that have gotten out of control or that danger life and property. To carry out these activities, the councils use real-time monitoring of environmental variables such as fuel load and state and atmospheric variables such as wind speed and direction and relative humidity, and to some extent also use forecasting of future conditions. They draw on remote sensing imagery and have extensive interactions with other agencies, local communities (both Aboriginal and Euro-Australian) and landowners. These visits were concentrated at the regional level, where operational decisions are often made, one step down from the state or territorial level, where broader policies are set. It was very useful to see the ways that agency staff drew on remote sensing imagery and on forecasts. Email exchanges, following up on this face-to-face contact, have continued to the present. Orlove also visited regional development corporations, charged more broadly with overseeing the economic and social development of regions; these seek to integrate land management decisions in the larger framework of economic growth, security and other national policy priorities.

During this visit, Orlove also visited Aboriginal development corporations. These organizations have responsibilities for promoting the sustainable and culturally appropriate economic development of particular Aboriginal communities and lands, with furthering Aboriginal autonomy and self-determination, and with addressing other pressing needs such as health and education. They often act as intermediaries between local Aboriginal communities, other Aboriginal organizations, and government agencies. These visits were useful for establishing contacts. They permitted a clearer view of local priorities and of the process of establishing and promoting projects.

In addition, Orlove had briefer interactions with local pastoralists (owners of large cattle estates, or long-term leaseholders). These families, often resident in the region for five or more generations, are closely involved with land management, fire starts and control, and local implementation of policy.

B. Interactions with climate forecasting community

The visit in March 2004 allowed Orlove to make two visits to the headquarters of the Australian Bureau of Meteorology in Melbourne, and to meet with staff involved in forecasting interannual variability. The matter of constructing Fire Danger Indices was discussed in detail. He also met with the staff involved in the Indigenous Weather Knowledge website at the Bureau, which coordinates



closely with Aboriginal communities to find appropriate ways to disseminate, within Australia and abroad, information about Aboriginal weather knowledge. Following on these visits, Orlove met with Bureau staff in Darwin and Cairns, getting a better sense of the operations of these units and their perceptions of the forecast-users to whom they provide information.

In December 2004, Orlove visited the headquarters of The Weather Channel in Atlanta, along with two other anthropologists, Kenny Broad (University of Miami) and Carla Roncoli (University of Georgia), and with a psychologist, Elke Weber (Columbia University). We met with climatologists, other scientists and production staff. Our conversations drew on our research, including this ongoing research in Australia. We covered topics of forecast production, dissemination, comprehension and use. We also discussed possible areas of collaboration in production of programs and in assessing the comprehension and use of different forecast products.

C. Coordination with other projects

This project overlaps considerably with the OGP project in Uganda of Phillips/Orlove, since it addresses issues of forecast communication, of interaction of scientific and traditional forecasts, and of the presence of state agencies in ethnically diverse rural areas with complex patterns of landownership. In both cases, local forecast-users are particularly concerned to receive forecasts at particular times of year, and to receive information about variables that can be difficult for meteorologists to predict, and in both cases there is a growing awareness in the national government of the importance of linking with indigenous communities. However, the rapidly shifting patterns of land title

in Australia are very distinct; these create possibilities of new forms of partnership, but also can lead to uncertainty and distrust in certain cases.

These general themes are consonant with findings presented at the conference “Insights and Tools for Adaptation: Learning from Climate Variability,” held in Washington, DC on 18-20 November 2003 and sponsored by the OGP, particularly the papers “Coping and Adapting to Climate Variability: The Role of Assets, Networks, Knowledge and Institutions” by Valdivia et al. and “Interannual Climate Variability and Agriculture in Argentina: What Did We Learn?” by Podestá et al., which emphasize the importance of building networks between forecast-providers and forecast-users.

III. Accomplishments

A. Brief discussion of research tasks accomplished

Orlove visited Australia in March 2004, spending several days in Melbourne at meetings with the Australian Bureau of Meteorology and with the School of Geography and Environmental Studies and the Center for Australian Indigenous Studies at Monash University.

A stay of several weeks in the Northern Territory allowed for meetings with the Bushfire Council, with researchers at Charles Darwin University (formerly the Northern Territory University) and at the Tropical Savannah Cooperative Research Centre. Orlove met with staff at the North Australian Indigenous Land and Sea Management Alliance, an Aboriginal group promoting title to land and to marine resources, as well as sustainable livelihoods and traditional environmental practices. During this visit, Orlove traveled to Maningrida and met with representatives of the Bawinanga Aboriginal Corporation and the Maningrida Progress Association, and had opportunities to interact with local residents and traditional owners in the town of Maningrida, in outstations and on the Liverpool River. A subsequent visit to Queensland provided an opportunity for meetings with staff at the Balkanu Cape York Development Corporation and the Cape York Peninsula Development Association, as well as with researchers at James Cook University and the Rainforest Cooperative Research Centre.

During these visits, open-ended interviews were conducted on a number of topics, including different forms of land title, patterns of use of terrestrial and aquatic resources, traditional environmental knowledge, adoption of modern technology, and patterns of fire use. It was also possible to observe the ongoing operations of the numerous organizations and programs that provide unemployment benefits, housing, employment and social services to Aboriginal people, and that apply Australian laws and regulations in these areas. Oral histories regarding previous fires were also collected to uncover perceptions of interannual variability and environmental change. One elder accompanied a story, told under a shade structure near his home, with drawings in the dust, a striking traditional practice. The PI was invited to participate in a session clearing brush that had encroached on a sacred waterhole and also to collect material for a mericulture project; the PI also had the opportunity as well to accompany a group of traditional owners when they traveled to harvest eggs from the nests of salt-water crocodiles. Care was taken to work within the multiple frameworks protecting human subjects, traditional cultural rights, and intellectual property rights.

The stay in Darwin permitted visits to the Northern Territory Archives Service. This provided the opportunity to review a number of important documents about the early history of Maningrida, its founding during a period of concern about the movement of Aboriginal people into Euro-Australian dominated towns, and the profound tensions created by the settling of people of different language groups in a single settlement. The archives of the Maningrida Mirage, a newsletter written by and for the Euro-Australian residents of Maningrida (schoolteachers, health workers, social welfare personnel and the like) gave strong insight into the ongoing relations between the two very different cultural groups.

Fire logs were discussed with traditional owners in Maningrida. Different drafts were circulated to find forms that would be of interest and use to the traditional Aboriginal communities in Maningrida and that would permit the preparation of data summaries and reports that would be of use to researchers elsewhere in Australia and the world. Care was taken to assure comprehensibility of the forms, ease of collection and data entry, recognition of the position of traditional owners, and coordination with remote sensing. Efforts were made to assure that Aboriginal cultural categories were not too rapidly assimilated into the frameworks of Western science; for example, there were discussions of ways that Aboriginal people pay attention to the sounds that fires make, as well as to their appearance and their spatial characteristics.

Remote sensing activities consisted of acquiring MODIS 250 meter resolution satellite imagery over a region in the NT. Images were downloaded from March to October on the 1st, 7th, 14th, 21st and 28th of each month. Unfortunately many images were distorted, the swath missed the study site or in most cases there was extensive cloud cover. To combat these difficulties, other days between the above dates were selected to analyze burn scar size and distribution. Daily weather observations of nearby weather stations were accessed from the Bureau of Meteorology for the entire dry season to assist in choosing days of little or no cloud. The images were geometrically rectified and radiometrically calibrated. Parallelepiped classification was performed on a selection of these images that best represented the respective month. The data were then imported into ARC map where, with the aid of the parallelepiped classification, each fire was visually detected and then digitized to form a polygon. The individual polygons of burn scars over the season enabled analysis of location, shape and size of each fire. These methods were validated in two ways: using Landsat data, which uses a higher resolution, to give a more accurate representation of the fire scar, and conducting ground truthing of a region.

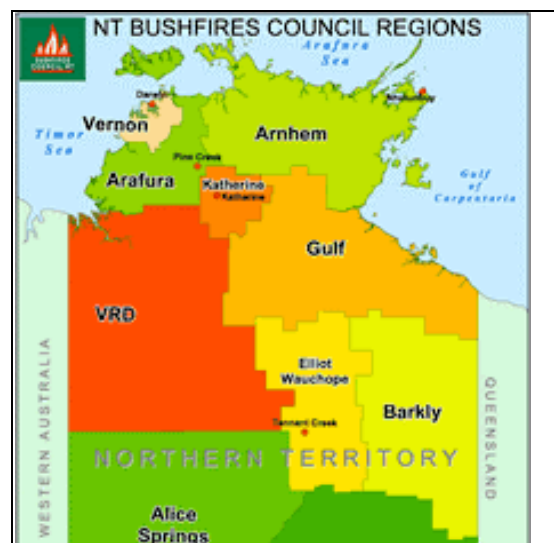
B. Summary of preliminary findings

Changing political situation. One of the most striking findings was the dramatic change in the political situation of Aboriginal peoples within Australia in general, and in the organization of fire governance in northern Australia in particular. These changes are working in opposite directions, since there has been a reduction in Aboriginal self-governance at the national level but at least some increases at the state and territorial level.

At the national level, the Aboriginal and Torres Strait Islander Commission was founded in 1989 to allow greater Aboriginal autonomy. It grouped many programs linked to Aboriginal peoples within a single agency, under Aboriginal leadership and management. The established of ATSIC was linked to the movement for the recognition of Aboriginal

land title that unfolded in the 1980s and culminated with a major court decision in 1992. In April 2004, the government, led by the conservative Liberal Party, decided to end ATSIC and to disperse programs linked to Aboriginal peoples back to different ministries. It argued that ATSIC was corrupt and inefficient, and it also drew upon a backlash against Aboriginal rights in certain sectors of Australian society. The opposition Labour Party, which generally has supported Aboriginal causes, agreed with this plan, though they called for some official organization to represent Aboriginal peoples directly. At present, the Senate Select Committee on the Administration of Indigenous Affairs is evaluating different forms of management of programs concerning Aboriginal peoples, and is charged with reaching a decision by March 2005. This shift directly affects the numerous Aboriginal organizations that are involved in supporting traditional fire practices, and has many indirect impacts on local communities as well.

At the state and territorial level, fire management is being restructured. In the Northern Territory and Queensland, rural fire brigades grew out of self-help organizations of largely autonomous Euro-Australian pastoralists, who set fires to reduce shrub encroachment and who worked together to control wildfires. These organizations were strongly opposed to Aboriginal burning. In the Northern Territory, the principle organization is the Bushfires Council of the NT, part of the NT Department of Infrastructure, Planning and Environment, which was created in November 2001 from the Department of Transport and Works, the Department of Lands, Planning and Environment, and Parks and Wildlife Commission of the NT. The NT has been divided into nine Fire Control Regions corresponding to the diverse climates, soils, vegetation and economic activities in this large and sparsely populated territory. In 2004, a tenth Region was created that includes the large Aboriginal Reserve in Arnhem Land, the relatively strong Aboriginal area of Groote Eylandt, the internationally known Kakadu National Park (which has a significant level of Aboriginal co-management) and the important, though not as well known, Cobourg National Park. The members of the committee that will govern this Region will be Aborigines. This is a substantial change that is likely to lead to increased Aboriginal participation in other Regions, such as Arafura, Victoria River Downs, and Alice Springs West and East. In Queensland, the Rural Fires Service has responsibility under the Queensland Fire and Rescue Service for managing fire across rural zones, which constitute 93% of this large state, with extensive pastoral areas. The state is divided into fifteen Districts. The northernmost Cairns Peninsula District includes the extensive Aboriginal lands on the Cape York Peninsula; this area also contains Lakefield National Park, a large park



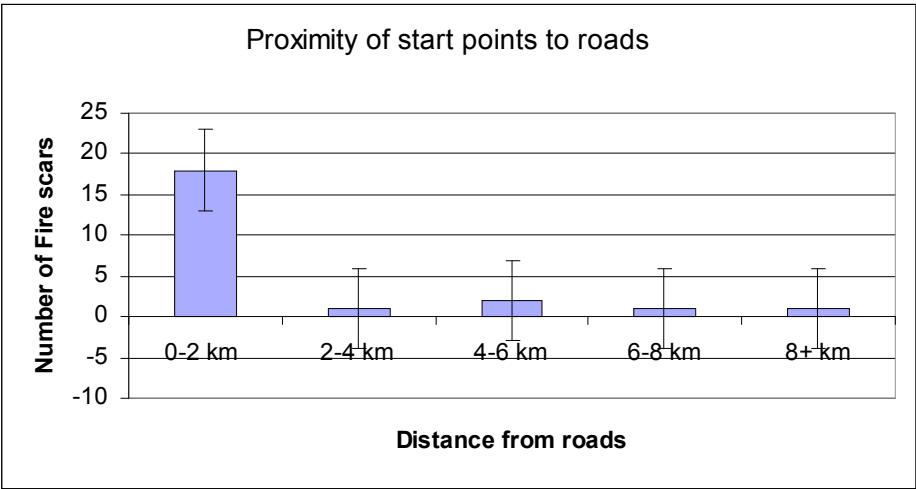
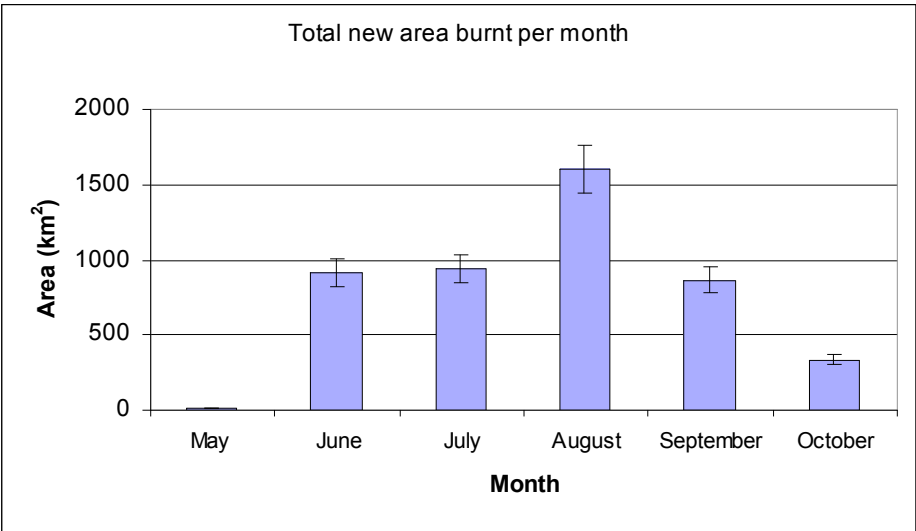
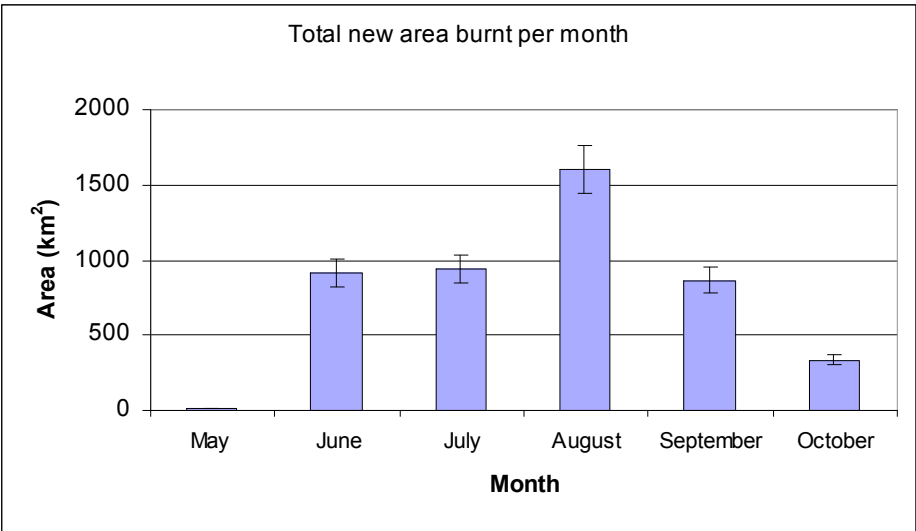
which consists of former pastoralist estates, which had been under effective Aboriginal control until early in the twentieth century. In

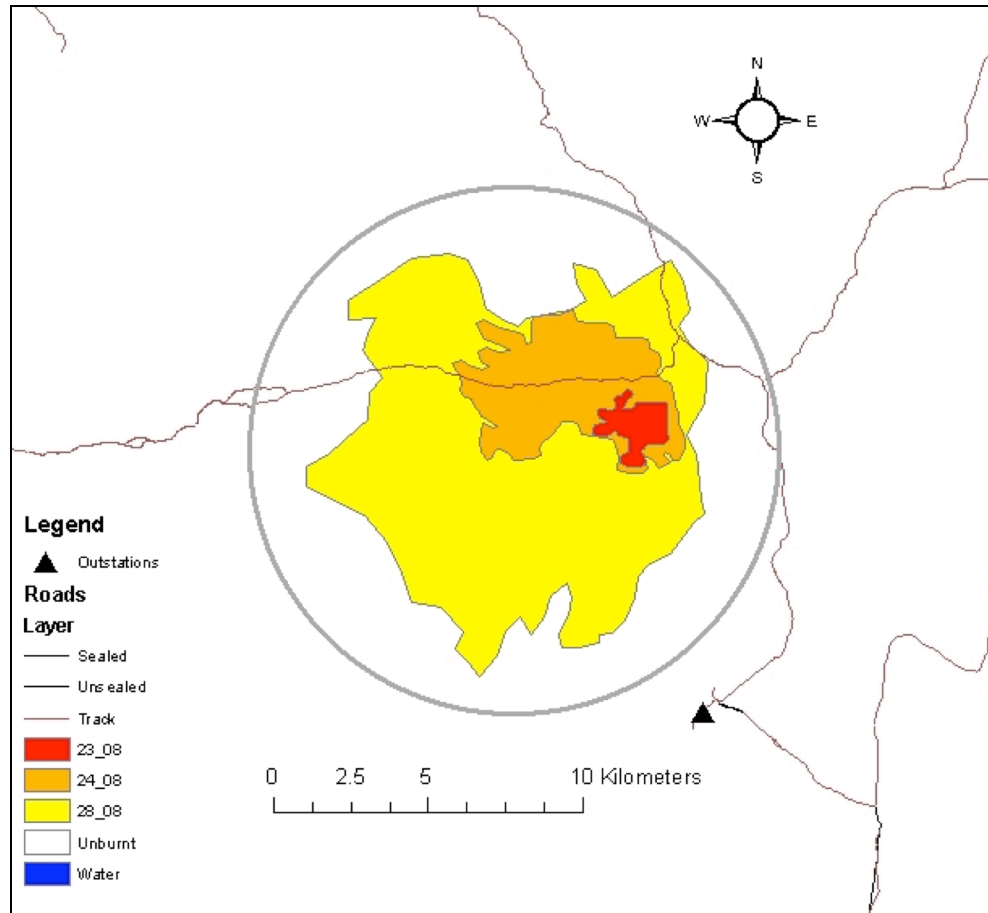
source:

www.ipe.nt.gov.au/whatwedo/bushfires/

2003, the Queensland Parks and Wildlife Service, which manages national parks within the state, allowed Aborigines whose clans formerly resided on these lands to return to them. They are now promoting Aboriginal co-management of fire, though the tensions of this effort are shown by the differences between two statements in the National Park's website: Kuku Thaypan, are closely involved in managing the park" and "fire management program is guided by a comprehensive Fire Management System, which provides processes and guidelines to facilitate the planning, implementation and monitoring of fire management."

Remote sensing. Remote sensing of fire starts and scars was conducted for the dry season in 2004 in a region of Arnhem Land in the NT. Most fires were relatively large, averaging about 200 km² in area. As shown by the attached figures, taken from "The temporal and spatial distribution of dry season fires...", Burns 2004, fire starts were distributed through the dry season, which began later than usual in that year. They peaked in the second half of the dry season. Fire starts were concentrated near roads. A number of sources suggest that traditional fire starts were distributed widely through the country and that they often took place early in the dry season; the difficulties of access to areas remote from the main settlement of Maningrida may account for the current patterns. The final figure shows the possibility of tracing the advance of individual fire scars during the research period; it demonstrates the importance of the prevailing winds (southeasterlies) in spreading fires. The slow rate of spread is consonant with the ground-based observation that the fires are fairly cool and confined to the understory, as is the observation from MODIS data that vegetation returned within weeks.





Local knowledge. Qualitative information demonstrated the importance of fire knowledge and practice in Aboriginal identities. Elders mentioned the importance of assuring that younger generations, particularly the males, acquired this knowledge, and they indicated that it was important for this knowledge to be transmitted out in the country itself. The responsibility to make sure that land is properly burned falls on the families who are the traditional owners of clan territories. The boundaries of these territories are learned by traveling through the territory, and stories are best learned on the land to which they are attached. Interestingly, pastoralists expressed similar attitudes, indicating that their families had responsibilities for keeping pastoral lands in a proper state from generation to generation. Members of both groups express a willingness to use new technologies to extend learning. Several senior Aboriginal men indicated that the use of written fire logs, accompanied by digital photography, would be a way to instruct younger people in fire knowledge, and they showed interest in remote sensing and web-based monitoring. They show a variety of attitudes, from positive to negative, towards the use of modern technologies, such as aerial starts, to initiate fires. (A traditional technique is illustrated in the image below.) Participation by members of pastoralist families in training courses is high, though these groups often still express considerable distrust of Aboriginal fire technologies.



C. List of papers and presentations

Source: [/www.nrdc.org/onearth/05win/fires1.asp](http://www.nrdc.org/onearth/05win/fires1.asp)
Use of bark from the paper-bark tree to start a low-intensity blaze.

Monash University,
Melbourne, Australia, School of Geography and Environmental Sciences, invited lecture,
“Anthropological perspectives on climate variability: general issues and case studies”
March 2004

Bureau of Australian Meteorology, Melbourne, Australia, invited lecture, “How people
name seasons” March 2004

The Weather Channel, Atlanta, “Overview on climate perception and social science”
(with Elke Weber, Kenny Broad and Carla Roncoli) December 2004

D. Discussion of deviations from proposed work plans

Though Orlove’s earlier visits concentrated in the Northern Territory site, the Queensland site looks more promising for ground-based field work. The creation of the new Arnhem region is occupying the attention of many individuals associated with fire starts, so that they are not as available as they had first seemed. In a complementary fashion, the growing interest of groups in Cape York in Queensland is promising to allow more collection of data there, possibly through videotaping and audio taping as well as with written fire logs.

IV. Relevance to the field of human-environment interactions

A. Contribution of results to field of use of climate information

This work demonstrates the importance of the institutional context of climate information. Individuals may draw on one or both systems of climate information to assess the time and location of fire starts. However, their access to territory in order to start fires depends on the particular systems of regulations, which have varied considerably in recent decades.

It is interesting to note too the cultural overlays of climate information. Aboriginal groups take great pride in the depth of their knowledge of country. They feel that the length of their experience and the intimacy of their knowledge give them a strong basis for determining burning patterns. They are concerned to pass this information on to future generations. Quite similar statements could be made about the views of the Euro-Australian pastoralists, who have been resident in northern Australia for at least three or four generations, and in many cases five or six, and who These statements could apply as well to the planners and resource managers, whose knowledge derives from international science rather than from local knowledge.

Nonetheless, there are many points of overlap among these groups, who find complementarities between their technologies and methods of transmission of information. Even though obstacles face the coordination of indigenous and national agencies in managing fires, Australia has progressed far beyond the United States in this regard. It is very hard to imagine that the US National Park Service would consider co-managing fire in Yosemite with Miwok, as the Queensland Parks and Wildlife Service is doing with Kuku Thaypan in Lakefield National Park, or that the US Forest Service would allow fire in Apache National Forest in Arizona to be co-managed with the

Apache (for whom the forest is named), as the NT Bushfires Council is currently allowing.

B. Links to other HDGEC research

Other NDGEC studies have demonstrated the detail of local systems of knowledge of climate variability. They have shown that local indicators can be used to observe the progress of seasons and to accommodate interannual variation. Phillips and Orlove's work in Uganda has shown the close attention to local 'signs' (such as shifts in wind direction, changes in nightly minimum temperature, and arrival of migratory birds) to indicate the onset of rains. Farmers in several language groups in southern Uganda use this information to determine the timing of field preparation, the selection of crop varieties, and the patterns of livestock movement. The pattern of transmission of information seems more broadly diffused through society, since the signs and their significance are topics of common conversation rather than part of a more institutionalized transmission process as in Australia. Kirshen's project in Burkina Faso in West Africa shows generally similar results. Valdivia, Gilles, Quiroz and Jetté have shown that indigenous farmers in highland Bolivia similarly monitor the progress of the seasons to choose planting dates for their principal crop, potatoes; here, the knowledge appears to be less widely diffused, since different individuals often do not discuss the signs that they observe with others.

C. Contributions to study areas

- i. *Adaptation to long-term climate change.* These cases show the variability in time-scale with which human groups adapt to environmental variability and change. The detailed Aboriginal knowledge of seasonality comes from the millennia of residence in the region. The Euro-Australian pastoralists have lived in the region for several generations, enough to witness considerable variation, and there is evidence as well that they adapted some burning techniques from the Aborigines who worked on their ranches
- ii. *Institutional dimensions of global change.* Debates over greenhouse gasses. Discussions have already begun about the importance, within the context of greenhouse gas emissions, of fires in the eucalyptus woodlands of northern Australia. Since there is spatial and temporal variability in burning patterns, and since fires differ in terms of the heat at which they burn and the percentage of fuel which is burned, there is also variability in the quantity and composition of gasses that are released. This variability may also influence the storage of carbon in plants and soil. This may well lead to debates over the responsibility for the emissions (fires set by different groups may release different amounts and types of gasses associated with climate changes) and with credit for the emissions (different groups could claim credit to trade carbon emission rights in some global exchange system).
- iii. *Developing tools for decision-makers and end-users.* Two very different groups have both made extraordinary leaps to the use of remote sensing and web-based technology: Aborigines, who have displayed a tremendous facility with the use of digital photography and whose pre-modern patterns of use of graphic icons in story-telling (as in the case of drawing in the sand) seem to offer a pre-adaptation to the Internet, and pastoralists, who have overcome a historical opposition to more educated professionals from distant cities in southern Australia to make use of radio (since the founding of the School of the Air in 1951, following in a way on the Flying Doctor Service that started in

1928). They demonstrate the importance of the development of long-term relationships between agency staff and end-users for the eventual acceptance and use of this technology.

iv. *Matching new scientific information with local/indigenous knowledge.* Australian government agencies have shown a great willingness to acknowledge indigenous knowledge. There are certainly few counterparts to the Australian Bureau of Meteorology's website on Indigenous Weather Knowledge (www.bom.gov.au/iwk). However, there remain significant difficulties in the implementation of the joint use of this information, since some agencies are unwilling to modify their procedures to allow for the social (rather than the knowledge-based) aspects of indigenous resource management (including the lack of written plans, the importance of face-to-face conversation in decision-making, and different forms of property rights).

v. *Role of public policy in the use of climate information.* The case of Australian bushfire management demonstrates the multiple levels of policy formation. The recent trends in that country are contradictory: weakening support of Aboriginal resource management at the national level, increasing support at the state and territorial level, ongoing tensions at the local level, and growing global and international governance of activities linked to emissions of greenhouse gasses and carbon sequestering.